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## Evaluation and Management of Chronic Wasting Disease Transmission

### Contact Information:

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### National Wildlife Research Center Scientists Assess the Potential for Chronic Wasting Disease (CWD) Transmission Between Wild and Domestic Cervids and Develop Methods to Reduce/Manage the Disease

Wildlife Services' (WS) National Wildlife Research Center (NWRRC) is the only Federal research organization devoted exclusively to resolving conflicts between people and wildlife through the development of effective, selective, and acceptable methods, tools, and techniques.

As increased urbanization leads to a loss of traditional wildlife habitat, the potential for conflicts between people and wildlife increases. Such conflicts can take many forms, but recently the potential for the transmission of diseases among wildlife, livestock, and humans has received greater attention.

#### Major Research Accomplishments:

- WS determined the risk associated with direct and indirect contact between farmed and wild cervids at fencelines relative to the potential for CWD transmission.
- WS evaluated white-tailed deer and mule deer ecology along riparian areas relative to the transmission and spread of CWD.
- WS developed new methods to test for the presence of CWD in live and dead animals.
- WS determined the minimum fence height that deer cannot breach.
- WS identified focal sites where CWD is likely spread in the wild and is developing ways to disinfect these sites.
- WS is working to develop a CWD vaccine.
- WS is developing products to disinfect surfaces and areas contaminated with CWD.
- WS is helping to determine the origin and transmission routes of CWD.

Chronic wasting disease (CWD) is a fatal neurological disease that infects captive and wild cervids. North American cervids susceptible to CWD include white-tailed deer (*Odocoileus virginianus*), mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), and moose (*Alces alces*).

CWD is caused by abnormal proteins that lack nucleic acids called prions. Prions change normal proteins in the host animal's cells resulting in concentrations of abnormal proteins. Over time, these abnormal proteins accumulate in the central nervous and lymphatic systems causing a degenerative lack of control and a "wasting-away" death.

There is no known cure or vaccine for CWD. The origin of CWD is unknown. The disease may have existed in the wild or began in captivity under abnormally high deer densities. CWD was first observed in 1967 at the Colorado Division of Wildlife's Research Facility in Fort Collins, CO, where it was initially believed to be malnutrition. In 1977, CWD was determined to be a transmissible spongiform encephalopathy and the first infected wild animal, an elk from Rocky Mountain National Park, was diagnosed in 1981.

NWRRC scientists are working to develop methods to reduce the transmission and spread of CWD.

### Applying Science and Expertise to Wildlife Challenges

**Interactions of Wild and Farmed Cervids through Game-Farm Fences**—NWRRC biologists used track plots and motion-activated video to determine how farmed and wild cervids (mule deer, white-tailed deer, and elk) interacted through game-farm fences.

The primary objective was to determine the degree of risk for disease transmission along



game-farm fences. Contact between farmed and wild white-tailed deer was less common than between farmed and wild elk, though potential for direct and indirect contact does exist. The least contact occurred where there were double woven wire fences. NWRRC scientists are currently determining the effectiveness of electric fence in conjunction with a single woven-wire fence for reducing contact.

**Ability of White-tailed Deer to Jump Game-Farm Fences**—Deer can breach fences by going over, through or under. One concern is that wild deer will jump the fences into captive deer farms, thus exposing those deer to disease. Officials in APHIS' Veterinary Services program are currently developing fencing recommendations that will be required for captive cervid operations to be in compliance with the VS program to control CWD. Agencies need information on the ability of deer to breach fence systems.

As an initial step in determining the minimum fence height that deer cannot breach, NWRRC scientists reviewed the literature and anecdotal evidence and conducted field tests on the containment efficiency of fence systems under different motivation scenarios for deer. Human drivers and humans plus dogs were used to motivate deer to breach fence systems. All deer successfully cleared the test fences when fence height was set at 3, 4, or 5 feet. When fence

height was set at 6 feet, 91 percent of deer cleared the fence. At a height of 7 feet only 10 percent of the deer jumped the fence, and no deer cleared the fence at 8 feet. These results will be useful in setting standards for fence height for security and containment of captive deer herds.

**Transmission and Spread of CWD**—CWD is spread from animal to animal by direct contact (i.e., nose-to-nose) or by contamination of feed or environment with saliva, urine, and/or feces. CWD can also be transmitted through the environment in soil contaminated by decomposing carcasses. The spread of CWD likely occurs by two main conduits: 1) through the natural dispersal and migration of wild cervids, and 2) by the inter- and intra-state transport of captive farmed cervids.

In western Nebraska, where CWD occurs, NWRC is using telemetry to learn about the ranges and movements of mule and white-tailed deer. At the same time, surveillance is being conducted at the county level to locate infected deer, particularly along the North Platte River. The potential exists for CWD to move east along the river rather quickly if management actions are not taken. NWRC researchers are also continuing a

long-term study of the ecology of deer along the Missouri River. Data from these studies are being used in the development of movement models and formation of management decisions.

**Sanitation and Decontamination CWD-infected Surfaces and Sites**—Meat processors, hunters, farmers, and other constituents need effective methods and techniques for eliminating the spread of CWD and other transmissible spongiform encephalopathies (i.e., Bovine Spongiform Encephalopathy, scrapie, Crutzfeld-Jacob Disease). NWRC scientists are developing an enzymatic product that breaks down prion proteins, rendering them harmless. This product could potentially be used to sanitize and decontaminate tools, surfaces, facilities, mineral licks and other areas infected with transmissible spongiform encephalopathies.

**Development of Efficient Means to Detect CWD in Cervids**—NWRC scientists and collaborators are developing more efficient methods for detecting CWD in both dead and live cervids. Current tests on dead animals are expensive and time-consuming, which limit the number of animals tested. Live tests are quite invasive, require anesthesia and are only effective for deer. With collaborators, NWRC scientists developed a rectal biopsy test for CWD that works on living or dead cervids, is easy to perform and can be repeated on individuals over time. NWRC scientists are currently working with State and Federal agencies to test and validate this new tool.

**Vaccine Development**—NWRC scientists have developed two experimental CWD vaccines that performed well in a mouse model. Efforts are underway to evaluate these candidate vaccines in deer. This will be the first evaluation of a vaccine for CWD in cervids. At the same time, NWRC scientists are attempting to further optimize the candidate vaccines and improve their performances in the mouse model.

**Determination of Focal Points for CWD Transmission in the Wild**—Through research with animal-activated cameras, NWRC scientists are quantifying cervid visits to focal sites, such as mineral licks and wallowing areas, and documenting behaviors that could lead to disease transmission. For white-tailed deer, results show that

the male breeding activity of establishing scrapes as signposts for communication are likely a means of disseminating and contracting the disease. In addition, for deer, elk, and moose, results show that mineral licks are likely to be focal sites for disease transmission. As modes for disease transmission become better understood and decontamination methods are developed, this information will help pinpoint specific areas for management activities.

**Testing of Prion Inactivation Methods**—Prions, the causative agent of CWD, bovine spongiform encephalopathy, and the other transmissible spongiform encephalopathies, are extremely stable and difficult to denature. Because of this, using by-products and disposing of waste (i.e., potentially infected carcasses) is difficult as the materials may be infectious. Chemical digestion is thought to be an effective means of rendering infectious material. With collaborators, NWRC scientists are investigating whether digestion truly renders infectious material non-infectious. If so, these materials could be used for producing products like pet foods and bio-fuel.

## Selected Publications:

Seamans, T. W., and K. C. VerCauteren. 2006. Evaluation of ElectroBraid™ fencing as a white-tailed deer barrier. *Wildlife Society Bulletin* 34: 8-15.

VerCauteren, K. C., J. M. Gilsdorf, S. E. Hygnstrom, P. B. Fioranelli, J. A. Wilson, and S. Barras. 2006. Green and blue lasers are ineffective for dispersing deer at night. *Wildlife Society Bulletin* 34: 371-374.

VerCauteren, K. C., M. J. Lavelle, and S. E. Hygnstrom. 2006. Fences and deer-damage management: a review of designs and efficacy. *Wildlife Society Bulletin* 34:191-200.

VerCauteren, K. C., M. J. Lavelle, and S. E. Hygnstrom. 2006. A simulation model for determining cost-effectiveness of fences for reducing deer damage. *Wildlife Society Bulletin* 34: 16-22.

VerCauteren, K. C., M. J. Lavelle, and J. Shivik. 2005. Efficacy of an animal-activated frightening device on urban elk and mule deer. *Wildlife Society Bulletin* 33: 1282-1287.

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## Groups Affected By These Problems:

- Wildlife and natural resource managers
- U.S. citizens
- Livestock producers and farmers
- Sporting organizations
- Consumers
- Meat processors
- Rural communities
- State and federal agriculture and wildlife agencies

## Major Cooperators:

- USDA/APHIS/Wildlife Services
- USDA/APHIS/Veterinary Services
- University of Nebraska
- Colorado State University
- State Departments of Public Health
- Wisconsin Department of Natural Resources
- Colorado Division of Wildlife
- Michigan Department of Natural Resources
- University of Wisconsin
- Cervid Research and Recovery Institute
- Private elk farmers